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PSYCHE

Vol. 68 December, 1961 No. 4

AUSTRALIAN CARABID BEETLES VII. *TRICHOSTERNUS*, ESPECIALLY THE TROPICAL SPECIES

By P. J. Darlington, Jr.
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This is one of a series of papers describing new Carabidae of zoogeographic importance referred to in my account (1961b) of transition of Australian wet forest carabid faunas. Some other papers of the series, including a list of my localities, are referred to below (p. 130). The present paper is concerned with *Trichosternus,* especially with the comparatively little known tropical species. Types of new species are placed, at least for the time being, in the Museum of Comparative Zoology; paratypes, with C. S. I. R. O. at Canberra and usually in the Queensland Museum. Proportions given in the descriptions are calculated from actual measurements.

Items of geographic or evolutionary interest derived from *Trichosternus* are its total distribution; the occurrence of two very distinct (relict or primitive?) species, *fax* and *montorum,* high on Mt. Bartle Frere (one reaching Mt. Bellenden Ker too); the distribution of *T. frater* and its apparent allies (*subvirens* and *simplicipes* of South Queensland and *nudipes* to *fisheri* in the tropics), which form a group of mostly allopatric forms in which the male front tarsi have apparently been simplified in two different stocks and in which double invasion or hybridization may have occurred in a very limited area on part of the Atherton Tableland (pp. 122-125). Another case of hybridization (of *eungella* and *mixtus*) may have occurred on the Eungella Range (p. 127). See map for distribution of species on and north of the Atherton Tableland.

I cannot give an exclusive definition of *Trichosternus.* Characters used by Sloane (1894 etc.) and Tschitschérine (1902) fail among recently discovered species. Compared with *Nurus, Trichosternus* is usually smaller, more lightly built, with ♂ front tarsi usually dilated and with 3 segments squamulose below, while in *Nurus* the ♂ front tarsi are usually simple, rarely (*e.g.* in *N. atlas* Cast.) slightly dilated and with 2 segments squamulose. However, exceptional *Trichosternus*

DARLINGTON — TRICHOSTERNUS

resemble *Nurus* in having ♂ tarsi simple (*T. subvirens* Chd., *simplicipes* Sl., *nudipes* Darl., *soror* Darl.) or with only 2 segments squamulose (*setosiceps* Sl.). Compared with *Notonomus, Trichosternus* is usually larger, often with prosternal process setose (rarely in *Notonomus*), often with alternate intervals of elytra raised, and often without distinct 10th intervals at outer edges of elytra, but all these characters fail in some species. A generic revision of the larger Australian pterostichines is much needed. The Australian genera should be compared with the New Zealand ones (Britton 1940) and phylogenies should be worked out if possible, and the old types, many of them in Europe, should be re-examined. However, I cannot undertake all this now.

The known range of *Trichosternus* is the eastern edge of Australia from the base of the Cape York peninsula (south of Cooktown) to central New South Wales (perhaps a little north of Sydney), with one species isolated in southwestern Australia (Darlington 1953) and another on New Caledonia. All the *tropical* Australian species (except *cordatus*) live in rain forest, but some more-southern species occur in savannah woodland, and some enter or are confined to south temperate rain forest on the Dorrigo-Ebor and Mt. Royal plateaus.

Before considering the tropical *Trichosternus,* I give the following tentative key to species south of the tropics, as a basis for comparison (*cf.* Sloane's key, 1899, pp. 567-569, and Tschitschérine's, 1902, pp.

Explanation of Plate 7

Known distribution of *Trichosternus* in tropical Queensland. The finely dotted line is the approximate eastern edge of high land (Atherton Tableland etc.). Arrows indicate occurrence southward, at increasing distances beyond the limits of the map, of the species indicated. The species are numbered in the order in which they are treated in the text. No. 1, on Mt. B(artle) F(rere), is *Trichosternus fax;* 2, *obscuripennis,* which extends north beyond the limits of the map nearly to Cooktown; 3, *montorum;* 4, *nudipes,* on the Mt. Spec plateau; 5, *soror;* 6, *frater,* which occurs north to Mt. Lewis and south beyond the limits of the map on the Kirrama Range; 7, *mutatus;* 8, *fisheri;* 9, *eungella,* and 10, *mixtus,* both on the Eungella Range; 11, *cordatus,* at the southern edge of the tropics; 12, *spec,* on the Mt. Spec plateau; 13, *setosiceps,* which is widely distributed on the south-central Atherton Tableland and occurs also south of the limits of the map on the Kirrama Range; and 14, *kirrama,* on the Kirrama Range. Nos. 1, 2, 3, 13, 14 are very distinct, phylogenetically isolated species. Nos. 4, 5, 6, 7, 8 are apparently interrelated, chiefly allopatric members of the *frater* group (see text). Nos. 9, 10, both on the Eungella Range, though structurally distinct, may be related to each other and may hybridize (see text). No. 11 represents a primarily south temperate rather than tropical stock. No. 12, on the Mt. Spec plateau north of Townsville, is apparently related to another south temperate (New South Wales) species.

523-530). I have specimens of all the 16 full species named in this key except *cyaneotinctus*.

Tentative key to Trichosternus *of eastern Australia south of tropics*

1. Elytral intervals 3, 5, 7 with seta-bearing punctures (Mt. Royal Range and highest part of Dorrigo-Ebor plateau; 2 species?) ..... *australicus* Sl.
- Only 3rd interval (if any) with seta-bearing punctures on elytral disc 2
2. Mesosternum setose anteriorly 3
- Mesosternum not setose anteriorly 7
3. Male front tarsi not dilated, not squamulose 4
- Male front tarsi dilated, 3 segments squamulose below 5
4. Alternate discal elytral intervals scarcely differentiated; greenish (extreme SE. Q. & adjacent N. S. W. border) .... *subvirens* Chd.
- Alternate discal intervals slightly elevated; black or nearly so, with cupreous or greenish margins (Bunya Mts., S. Q.) ..... *simplicipes* Sl.
5. Seventh elytral intervals sharply carinate at base; prothorax relatively broad at base; length *c.* 22 mm. (extreme NE. N. S. W. and adjacent Q. border) ..... *angulosus* Chd.
- Seventh intervals roundly costate at base 6
6. Very large, *c.* 33-40 mm. (SE. Q. to Blackall and Bunya Mts. etc.) ..... *renardi* Chd.
- Not so large, *c.* 25-32 mm. (N. S. W. S. to Dorrigo, Williams River, Booral, etc., and N. to Stanthorpe-Dalveen area, S.Q.) ..... *vigorsi* Gory
7. Three supra-ocular setae each side 8
- Two supra-ocular setae each side 9
8. Purplish (savannah woodlands of N. N. S. W. chiefly west of the rain forest zone) ..... *superbus* Cast.
- Greenish (unknown to me; may be another savannah woodland species) ..... *cyaneotinctus* Boisd. incl. *atroviridis* Sl.
9. Additional lateral prothoracic setae present (savannah woodland and drier rain forest of S.Q., N. into edge of tropics; probably includes *hecate* Tsch.) ..... *cordatus* Chd.
- Only usual 2 pairs lateral prothoracic setae present 10
10. Very large, 34 mm. or more 11
- Smaller, 34 mm. (maximum size of *cyaneus* only) or less 12
11. Prosternal process setose; black; length 37-42 mm. (extreme NE. N. S. W. and adjacent Q. border) ..... *perator* Sl.

- Prosternal process not setose; purplish; length 34-39 mm. (Blackall Range, SE. Q.) ..... *porphyriacus* Sl.

12. Posterior-lateral prothoracic setae near base .... at least 3 species: *wilsoni* Cast., *nitidicollis* Cast., and *speciosus* Sl.
- Posterior-lateral prothoracic setae about 1/8 of prothoracic length before base 13

13. Smaller, length *c.* 21-27 mm.; black sometimes slightly bluish or purplish (widely distributed in NE. N. S. W. and S. Q., from Dorrigo to Blackall Range ..... *marginiferus* Chd.
- Larger, length *c.* 28-34 mm.; wholly purple or blue (Mt. Royal Range, Dorrigo, etc.; possibly 2 species) ..... *cyaneus* Cast.

The following key to tropical Australian *Trichosternus* differs from the preceding key in form (ranges and authorities omitted) because the tropical species are discussed individually. All the species have rather long, strong, curved mandibles; rather short, irregular, subparallel frontal foveae; well developed, emarginate mentum tooth; palpi not strikingly modified; elytra margined at base; 8th (submarginal) stria lined with very small ocellate punctures; lower surface impunctate or nearly so except for usual "fixed" punctures; and (so far as my observations go) other usual characters of the genus, except as otherwise stated.

Key to Species of Trichosternus *of Tropical Australia*

1. Mesosternum setose anteriorly; dorsal elytral intervals equal or nearly so (except in *montorum*) 2
- Mesosternum not setose anteriorly; alternate elytral intervals elevated (except scarcely so in *kirrama*) 9

2. Seventh intervals of elytra not sharply carinate at base (at most somewhat swollen); elytra without dorsal punctures 3
- Seventh intervals sharply carinate at base; elytra with (small) dorsal punctures 4

3. Subparallel, prothorax quadrate; humeri subdentate; color blue-purple ..... *fax*
- Elytra oval, prothorax subcordate; humeri not dentate; black, elytra dull ..... *obscuripennis*

4. Elytra with alternate intervals moderately raised; (form depressed; color greenish or bluish) ..... *montorum*
- Elytra with discal intervals equal or nearly so, except at extreme base (*frater* group) 5

5. Male front tarsi not dilated, without squamules 6
- Male front tarsi more or less dilated, always with some squa-

mules below 7
6. Broader; greenish ..... *nudipes*
- Narrower; bluish or purplish ..... *soror*
7. Greenish ..... *frater*
- Black or purplish 8
8. Black or faintly purple; smaller (18-20 mm.) ..... *mutatus*
- Purple; larger (23-25 mm.) ..... *fisheri*
9. Only 2 pairs supra-ocular *and* 2 pairs lateral prothoracic setae (but extra apical ventral setae) present ..... *eungella*
- Extra supra-ocular *and/or* lateral prothoracic setae present 10
10. Prosternal process setose; if prosternal setae broken or not visible, note 3 supra-ocular and 4 or more median-lateral prothoracic setae each side, and odd elytral intervals costate ..... *mixtus*
- Prosternal process not setose 11
11. Only 2 pairs supra-ocular setae present, *and* odd elytral intervals raised 12
- Extra supra-ocular setae present, *or* odd elytral intervals (except 7th) scarcely raised and humeri scarcely dentate 13
12. Black ..... *cordatus*
- Purple ..... *spec*
13. Only 1 pair median-lateral prothoracic setae present; odd elytral intervals costate ..... *setosiceps*
- Extra lateral prothoracic setae present; odd elytral intervals (except 7th) not costate ..... *kirrama*

Trichosternus fax new species

Form as figured (Fig. 1), subparallel, not strongly convex; black, head slightly metallic, pronotum with green or bluish marginal channels and copper-purple on disc brightest in baso-lateral areas, elytra with marginal channels blue or greenish blue; pronotum shining, head and elytra slightly duller. *Head c.* 3/4 or slightly more width prothorax; eyes moderate, genae *c.* wide as eyes, rounded and somewhat narrowed to neck; antennae rather short (in genus), passing base of prothorax by 1 or 2 segments; 2 supra-ocular setae each side. *Prothorax* subquadrate, *c.* 1/3 wider than long at middle, not much narrowed behind; base *c.* 1/10 or more wider than apex (variable); apex broadly emarginate but angles not otherwise advanced, not margined; base subtruncate, slightly emarginate at middle, strongly margined at sides; sides weakly arcuate for much of length, broadly, slightly sinuate before *c.* right, well defined posterior angles; lateral margins narrow, slightly wider posteriorly, each with a seta about 1/3 from apex and on margin at basal angle; disc rather flat, middle

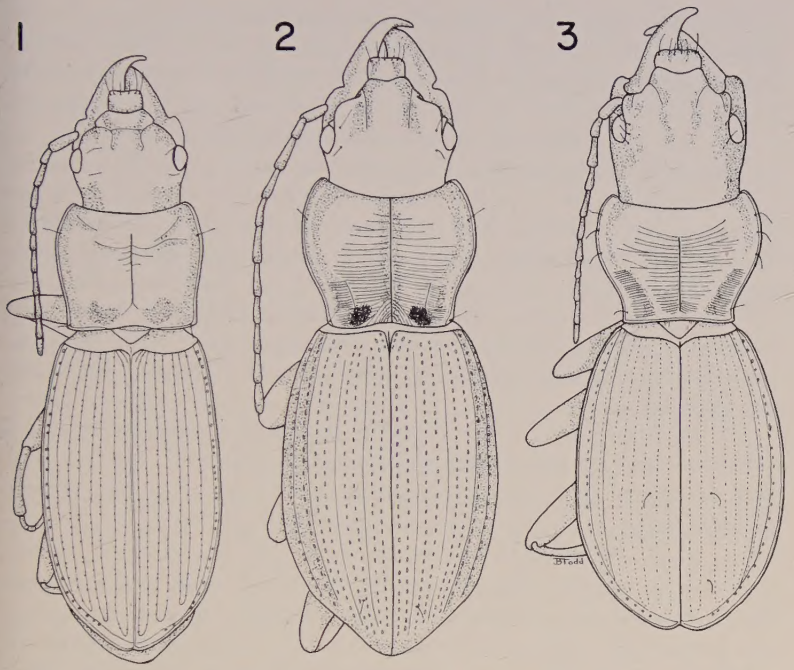

Fig. 1. *Trichosternus fax* n. sp. Fig. 2. *T. montorum* n. sp. Fig. 3. *T. kirrama* n. sp.

line deep, transverse impressions almost obsolete except for subbasal foveae each side midway between middle and sides, separated from margins by strong convexities; disc and foveae not punctate. *Elytra c.* 1/5 wider than prothorax, usually slightly narrowed anteriorly; margin rectangular or almost acute at subdentate humeri; elytra with striae well impressed and punctate; intervals slightly convex but not costate, 3, 5, and 7 slightly wider than others but not more elevated, except 7th slightly elevated at base; narrow 10th interval indicated posteriorly; dorsal punctures lacking. Mesosternum anteriorly and prosternal process setose. Male front tarsi slightly dilated, 3 segments squamulose; ♂ with 1, ♀ 2 setae each side last ventral segment. Length 20-23; width 6.5-7.7 mm.

Holotype ♂ (M. C. Z. Type No. 30,355) and 15 paratypes all from Mt. Bartle Frere, North Queensland, west slope 3000-5000 ft. (not found lower), Dec. 1957, collected by my wife, my son, and myself, in mountain rain forest.

This new species is sufficiently distinguished from others in the preceding key. It is not closely related to any other known species. It may prove to be generically distinct from *Trichosternus,* or it may be a relict of the ancestral stock of the genus.

Trichosternus obscuripennis (Macl.)

This is the northernmost *Trichosternus,* and it descends to relatively low altitudes. Macleay (1887, p. 220) described it from the Mossman River. Sloane had it from Helenvale south of Cooktown. I have it from Mt. Finnigan south of Cooktown, Thornton Peak near Daintree, Mt. Lewis near Mossman, and Black Mt. about 20 miles north of Kuranda. Although most of my specimens were taken at 2000 or 3000 ft. altitude, several were found at or below 1000 ft. in strips of rain forest along the trail between Thornton Peak and the Daintree River.

T. obscuripennis is a very distinct species but hardly a separate subgenus. Its lack of humeral teeth is approached in *T. kirrama,* and lack of dorsal elytral punctures is matched by *fax,* although neither of these species is close to *obscuripennis* in other ways.

Trichosternus montorum new species

Form as figured (Fig. 2), rather broad, depressed; black with bluish, purplish, or sometimes greenish reflections, head and pronotal disc moderately shining, elytra a little duller. *Head* about 4/5 width prothorax; eyes rather small, genae as wide or wider than eyes, irregularly arcuate and somewhat narrowed to neck; antennae rather long (in genus); 2 supra-ocular setae each side. *Prothorax* cordate; 1/3 (±) wider than long at middle; base slightly (± 1/10) narrower than apex; sides rounded for about 3/4 of length, then rather strongly sinuate before *c.* right, scarcely blunted posterior angles; side margins moderate, not much wider basally, each with a seta about 1/3 from apex and on margin at basal angle; apex not margined, broadly emarginate but angles not otherwise advanced; base broadly emarginate at middle, slightly rounded toward sides, vaguely margined at sides but not at middle; disc depressed, middle line deep, transverse impressions weak; baso-lateral foveae elongate but not strictly linear, slightly nearer margins than middle, not quite reaching middle of length, densely transversely rugulose, the rugulose areas meeting at middle posteriorly, with middle of base longitudinally rugulose; disc otherwise impunctate. *Elytra* oval, usually slightly narrowed anteriorly; margin somewhat obtusely angulate and finely toothed at humeri; elytra with finely punctate discal striae; intervals more or less convex, 3, 5, 7 increasingly elevated, 7th being sharply carinate for

most of length (most strongly so near base); 10th interval indicated but not well developed; each 3rd interval with 0, 1, or 2 dorsal punctures behind middle (often asymmetrical in number and position). Mesosternum anteriorly and prosternal process setose. Male front tarsi slightly dilated, 3 segments squamulose below; ♂ with 1, ♀ 2 setae each side last ventral segment. Length 23.5-27; width 7.9-9.1 mm.

Holotype ♂ (M. C. Z. Type No. 30,356) and 39 paratypes all from west slope Mt. Bartle Frere, North Queensland, 3000-5000 ft. (none lower), Dec. 1957, collected by the Darlingtons, in mountain rain forest. Also 6, not types, from east side Mt. Bellenden Ker, 3000-4500 ft., Dec. 1957, taken by myself, in mountain rain forest.

This seems to be a typical, rather generalized (primitive?) *Trichosternus,* without known close relatives. It is of course distinguished from other species in the preceding key.

Trichosternus nudipes new species

Form about average; greenish black, the green most distinct at sides and baso-lateral areas of pronotum and marginal channels of elytra; head and pronotum shining, elytra duller. *Head c.* 3/4 (by measurement) width prothorax; eyes small but abrupt, genae *c.* wide as eyes, convex, somewhat narrowed to neck; antennae of moderate length; 2 supra-ocular setae each side. *Prothorax* subcordate, moderately narrowed at base, *c.* 1/3 (±) wider than long at middle; base slightly (less than 1/10) wider than apex; apex broadly emarginate with angles (lateral channels) slightly advanced, not margined; base broadly emarginate at middle, slightly rounded laterally, margined laterally; sides broadly rounded for much of length, moderately sinuate near *c.* right or slightly obtuse, scarcely blunted basal angles; lateral margins narrow, not wider basally, each with 1 or sometimes 2 setae each side 1/3 or less from apex and 1 seta on margin at basal angle; disc not very convex, middle line fine, transverse impressions weak; baso-lateral impressions deep, *c.* 1/3 length prothorax, separated from lateral margins by convexities but extending inward somewhat vaguely nearly to middle; disc of pronotum impunctate except base irregularly rugulose. *Elytra* 1/3 or less wider than prothorax, suboval, slightly narrowed anteriorly; margins forming *c.* right or slightly obtuse, finely raised-dentate angles at humeri; dorsal striae very fine, finely punctate; each elytron with 7 (including suture) rather weak but almost entire costae, 7th carinate basally; 10th interval indicated toward apex; 3rd interval usually 2-punctate, the punctures at or before apical 1/3 and near apex, but individual punctures some-

times absent or obscured. Mesosternum anteriorly and prosternal process (sometimes slightly) setose. Male front tarsi narrow, without squamules; ♂ with 1, ♀ 2 setae each side last ventral segment. Length 22.5-26; width 7.9-9.5 mm.

Holotype ♂ (M. C. Z. Type No. 30,357) and 87 paratypes all from Mt. Spec plateau (Paluma Range), *c.* 40 miles north of Townsville, North Queensland, 2000-3000 ft., Dec. 1957 and Feb. 1958, taken by the Darlingtons, in rain forest; and 1, same locality, June 7-10, 1955, E. O. Wilson.

This is similar to and perhaps related to *T. subvirens* Chd. of South Queensland, but *subvirens* has an entire mentum tooth (emarginate in *nudipes*), posterior lateral pronotal setae just inside (not on) the margin, and lacks or nearly lacks rugulose sculpture on the base of the pronotum.

Trichosternus soror Darl.

I described this species (1953) from 3 specimens from Millaa Millaa, on the Atherton Tableland. I did not find it at this locality during my last trip, but found it on both the lower and upper western slopes of Mt. Bartle Frere, at 2000-3500 and 3000-5000 ft., and on the east side of Mt. Bellenden Ker, at 3000-4500 ft.

Although this small, bluish species has simplified male tarsi, like the preceding species, it may not be directly related to it but may be independently derived from a common ancestor perhaps resembling *frater* (below).

Trichosternus frater new species

Slightly more slender than average of genus, rather convex; greenish or bluish black, head and pronotum moderately shining, elytra somewhat duller. *Head* 4/5 or more width prothorax; eyes small, genae about wide as eyes, rounded and somewhat narrowed to neck; 2 supra-ocular setae each side; antennae of moderate length. *Prothorax* subcordate, *c.* 1/4 wider than long at middle; base slightly narrower than apex; apex broadly emarginate but angles otherwise scarcely advanced, apex not margined; base emarginate at middle, rounded toward sides, margined at sides; sides broadly arcuate through much of length, moderately sinuate toward base; basal angles *c.* right or slightly obtuse, scarcely blunted; side margins rather narrow; not much wider posteriorly, each with 1 seta near or before anterior 1/3 and 1 on margin at basal angle; disc with distinct middle line, less distinct transverse impressions, and moderate baso-lateral foveae which reach posterior margin but are separated from lateral margins by convexities; surface of disc nearly smooth except with some (variable)

transverse strigulation in baso-lateral impressions. *Elytra* slightly more than 1/4 wider than prothorax, subparallel, slightly narrowed anteriorly; margin forming obtuse (nearly right), slightly dentate angles at humeri; dorsal striae formed by fine vaguely punctulate impressed lines in low spaces between intervals; latter subequal on disc, slightly raised but not costate, except 7th strongly raised and costate basally, 10th interval indicated posteriorly; each 3rd interval 1- or 2-punctate posteriorly, position of punctures variable. Mesosternum anteriorly and prosternal process (sometimes inconspicuously) setose. Male front tarsi moderately dilated, 3 segments squamulose below; ♂ with 1, ♀ 2 setae each side apex last ventral segment. Length 20-23; width 6.5-8.0 mm.

Holotype ♂ (M. C. Z. Type No. 30,358) and 73 paratypes all from Kirrama Range, inland from Cardwell, North Queensland, 2000-3000 ft. altitude, Dec. 1957 and Feb. 1958, collected by the Darlingtons, in rain forest. Also the following specimens, not types: 12, mountains above (SW of) Atherton, Atherton Tableland, 3000-4000 ft., Dec. 1957 and Feb. 1958; 1, near Black Mt., *c.* 20 miles north of Kuranda, probably near 2000 ft. altitude, May 1958; and 3, Mt. Lewis, near Mossman, probably near 3000 ft., Dec. 1957; all collected by the Darlingtons, in rain forest. These localities are all on the Dividing Range system, which has probably been the principal path of north-south dispersal of wet forest Carabidae in North Queensland.

T. frater may represent the ancestral stock, with dilated, squamulose male tarsi, from which *nudipes* of the Mt. Spec plateau, *subvirens* and *simplicipes* of South Queensland, and also (independently) *soror* of the Atherton Tableland etc. have been derived. These 5 species (including *frater* itself) are all allopatric and are generally similar in form and technical characters except for the differences in the ♂ tarsi. The two following new species may be local derivatives of the same stock with ♂ tarsi still dilated and squamulose. See map for distribution of tropical species of the *frater* group.

Trichosternus mutatus new species

Small; form about average for genus but rather convex; black, sometimes with faint purplish reflections; moderately shining, elytra slightly duller. *Head* 3/4 to 4/5 width prothorax; antennae rather short, scarcely extending beyond base of prothorax; eyes moderate, genae *c.* wide as eyes, rounded and narrowed to neck; 2 supra-ocular setae each side. *Prothorax* subcordate, 1/4 (±) wider than long at middle; base equal to or slightly narrower than apex; sides broadly

but not strongly rounded in much of length, weakly sinuate before base; basal angles *c.* right or slightly obtuse, scarcely blunted; apex subtruncate or very broadly emarginate with angles scarcely advanced, apex not margined; base subtruncate or slightly emarginate at middle, slightly rounded-oblique toward sides, weakly margined only toward angles; lateral margins narrow, scarcely wider basally, each with 1 seta about 1/4 from apex and 1 on margin at basal angle; disc convex, middle line well impressed, transverse impressions rather weak; baso-lateral foveae rather weak and irregular, reaching posterior margin but separated from side margins by convex areas, not punctate and not much more rugulose than disc. *Elytra* slightly more than 1/4 wider than prothorax, rather short, slightly narrowed anteriorly; humeral angles nearly right, slightly toothed; striae represented by depressed spaces between intervals; latter subequal on disc, convex but not much elevated except 7th elevated and costate basally; 10th interval indicated posteriorly; each 3rd interval with 2 or 3 dorsal punctures posteriorly. Mesosternum anteriorly and prosternal process (sometimes inconspicuously) setose. Male front tarsi moderately dilated, 3 segments squamulose; ♂ with 1, ♀ 2 setae each side apex last ventral segment. Length 18-20; width 6.5-7.0 mm.

Holotype ♂ (M. C. Z. Type No. 30,359) and 4 paratypes from Mt. Fisher (see below), *c.* 4000 ft., Feb. 1958; and 5 additional paratypes from mountains above (SW of) Millaa Millaa, *c.* 3500 ft., Dec. 1957; all specimens taken by the Darlingtons, in rain forest. The two localities are close together in the mountain mass between Ravenshoe and Millaa Millaa on the Atherton Tableland, North Queensland.

This species differs from the preceding one *(frater)* in smaller size, color, smoother basal pronotal foveae, and other details. It differs from *soror* in form of ♂ tarsi, in being a little broader, different in color, and in other details. For further comments, see under following species.

Trichosternus fisheri new species

Larger than preceding; black with strong purplish reflections, moderately shining except elytra slightly duller. *Head* slightly more than 4/5 width prothorax; eyes moderate, genae *c.* wide as eyes, rounded and narrowed to neck; antennae rather long (in genus), passing base of prothorax by 2 or 3 segments; 2 supra-ocular setae each side. *Prothorax* subcordate, *c.* 1/4 or less wider than long at middle; base *c.* 1/10 narrower than apex; apex subtruncate or very broadly emarginate, with angles scarcely advanced; apex not distinctly margined; base

slightly emarginate at middle, faintly rounded toward sides, rather vaguely margined at sides; sides rather weakly rounded for much of length; moderately sinuate posteriorly before *c.* right, scarcely blunted basal angles; margins rather narrow, not much wider posteriorly; each with a seta about 1/3 from apex and on margin at basal angle; disc convex, with fine middle line and weak transverse impressions; basolateral foveae deep but irregular, more or less transversely striolate; surface of disc otherwise nearly smooth, except some striae radiating from a point near base. *Elytra* nearly 2/5 wider than prothorax, slightly narrowed anteriorly; margin forming strong but slightly obtuse, slightly toothed angles at humeri; striae vaguely punctate in clean specimens; intervals slightly raised but not strongly costate on disc, subequal except 3rd and 5th slightly more prominent at base and 7th carinate especially basally; 10th interval scarcely indicated; 3rd interval with usually 4 to 6 punctures, irregularly spaced. Mesosternum anteriorly and prosternal process (sometimes inconspicuously) setose. Male front tarsi only slightly dilated but usually with some squamae on 1st three segments (sometimes visible only on first segment — it is not clear whether they are worn off or originally missing on other segments in this case); ♂ with 1, ♀ 2 setae each side apex last ventral segment. Length 23-25; width 8.1-8.9 mm.

Holotype ♂ (M. C. Z. Type No. 30,360) and 3 paratypes from Mt. Fisher (see below), *c.* 4000 ft., Feb. 1958; and 2 paratypes from mountains above (SW of) Millaa Millaa, *c.* 3500 ft., Dec. 1957; all specimens taken by the Darlingtons, in rain forest. Both these localities are in the mountain system between Ravenshoe and Millaa Millaa, on the Atherton Tableland, North Queensland.

This species differs from the 2 preceding ones (in different ways) in details of form and color and size, in having ♂ tarsi less dilated, and in having more punctures on 3rd elytral intervals. It and *mutatus* appear to be confined to the same local mountain mass. Their occurrence together, localized between the ranges of *frater* on one side and *soror* on the other (see map), suggests some sort of double invasion or hybridization, although all the species in question now seem fully distinct.

Trichosternus eungella new species

Rather small, broad, depressed; black, virtually without metallic reflections, moderately shining, elytra (except marginal intervals and tops of costae) dull. *Head* 3/4 (±) width prothorax; eyes moderate, genae wide as or slightly wider than eyes, rounded and narrowed to neck; antennae rather long (in genus), passing base of prothorax by

about 2 segments; 2 supra-ocular setae each side. *Prothorax* subcordate, *c.* 2/5 or slightly more wider than long at middle; base slightly narrower than apex; apex broadly emarginate with angles slightly advanced, not margined; base broadly emarginate at middle subtruncate at sides; sides broadly rounded through much of length, rather strongly sinuate basally; posterior angles right or slightly acute, scarcely blunted; side margins moderate, not much broader basally, each with a seta about 1/3 from apex and on margin at or very near basal angle (additional setae rarely present anteriorly); disc with well impressed middle line and anterior transverse impression, weak posterior transverse impression but large irregular baso-lateral impressions; latter strongly transversely strigulose. *Elytra* 1/5 (±) wider than prothorax, slightly narrowed anteriorly; margin forming *c.* right (slightly obtuse) dentate angles at humeri; discal striae in clean specimens indicated by rows of rather vague punctures; even discal intervals scarcely convex, odd intervals costate; no distinct 10th interval; each 3rd interval usually 2-punctate, behind middle and on declivity. Mesosternum and prosternal process not setose. Male with front tarsi slightly dilated, 3 segments squamulose; ♂ with 2 or 3, ♀ with 3 or 4 (often asymmetrical) setae each side last ventral segment. Length 20-25; width 7.8-8.3 mm.

Holotype ♂ (M. C. Z. Type No. 30,361) and 53 paratypes all from the Eungella Range, west of Mackay, Queensland, 2000-3000 ft. altitude, Nov. 1957, taken by the Darlingtons, in rain forest.

This is apparently related to *T. wilsoni* Cast. of South Queensland etc., but *eungella* is slightly broader and more depressed, with stronger elytral costae. For possible hybrids of this and following species, see under latter.

Trichosternus mixtus new species

Form about average for genus, but prothorax strongly cordate and elytra oval; black without metallic color, head and pronotum moderately shining, elytra duller. *Head* large, 4/5 width prothorax; eyes moderate, genae *c.* wide as eyes, rounded and somewhat narrowed to neck; antennae rather long, passing base of prothorax by about 2 or more segments; usually 3 supra-ocular setae each side (only 2 on right side in one specimen, 4 on both sides in another). *Prothorax c.* 2/5 (±) wider than long at middle; base *c.* 4/5 or slightly more width apex; apex strongly emarginate, angles (marginal channels) advanced in arc of emargination; apex not margined; base slightly emarginate, finely margined; sides rounded for much of length, strongly sinuate about 1/6 of length before base, then subparallel to base;

posterior angles right or slightly acute, scarcely blunted; side margins moderate anteriorly, slightly wider posteriorly, each with 4 to 9 setae near and before middle (at least 4 on each side in all specimens) and 1 seta posteriorly well before angle; disc with usual middle line, weak transverse impressions, and rather weak baso-lateral foveae separated from base by transverse elevation; foveae strongly transversely strigulose, and base longitudinally strigulose. *Elytra c.* 1/4 wider than prothorax; margin forming *c.* right or slightly obtuse, dentate angles at humeri; striae in form of lines of small punctures (often obscured); even intervals scarcely elevated but intervals 3, 5, and 7 carinate, carinae of 3 and 5 not reaching base but 7th very strongly carinate basally; no 10th interval; each 3rd interval 2-punctate posteriorly. Mesosternum without but prosternal process with setae (all specimens — most setae broken off in 2 specimens but vestiges visible). Male front tarsi moderately dilated, 3 segments squamulose; ♂ with usually 2 or 3, sometimes 4 (often asymmetrical), ♀ with usually 4, sometimes 5 setae each side last ventral segment. Length 24-29; width 8.4-9.5 mm.

Holotype ♂ (M. C. Z. Type No. 30,362) and 23 paratypes all from Eungella Range, west of Mackay, Queensland, 2000-3000 ft., Nov. 1957, taken by the Darlingtons, in rain forest.

Superficially, *mixtus* is almost a miniature of *cordatus* but has extra supra-ocular setae, posterior pronotal setae farther from base, and a setose prosternal process. From *eungella,* with which it occurs, *mixtus* differs in form, extra supra-ocular and lateral prothoracic setae, position of posterior pronotal setae, and setose prosternal process. Most individuals of both species are unquestionably distinct. However, I have 5 specimens from the Eungella Range that have intermediate characters and that may be hybrids. They are intermediate in form; like *eungella* in having only 2 pairs of supra-ocular setae; intermediate in lateral pronotal setae (2 or 3 each side at and before middle, but with posterior setae near base); and like *eungella* in having prosternal process not setose. Only field study can determine the real status of these specimens.

Trichosternus cordatus Chd.

Although *cordatus* is primarily a South Queensland species, it extends into the tropics. It lives in drier woodland than most other members of the genus except *superbus* Cast. I found it at Beechmont (Queensland-New South Wales border); Benarkin; Yarraman; Biggenden (SW of); near Monto (in dry scrubby woods with *Pamborus*

viridis) ; and, in the tropics, at Byfield (N. of Yepoon) in semi-rain forest, and *c.* 40 miles S. of Mackay in good savannah woodland.

Trichosternus spec new species

Form nearly of *T. superbus,* with strongly cordate prothorax and oval elytra narrowed anteriorly; purple or purplish, not strongly shining, elytra slightly duller. *Head* large, slightly more than 4/5 width prothorax; eyes small, genae slightly wider than eyes, subparallel anteriorly, rounded and slightly narrowed to neck; antennae rather long, passing base of prothorax by about 2 segments; 2 supra-ocular setae each side (all specimens). *Prothorax c.* 2/5 or less wider than long at middle; base slightly more than 3/4 width apex; apex broadly emarginate except rounded toward sides, with angles (marginal gutters) slightly advanced; apex not margined; base broadly emarginate except oblique near angles, rather vaguely margined; sides rounded through much of length, strongly sinuate before basal angles; latter right or slightly obtuse, not much blunted; lateral margins rather narrow anteriorly, broader posteriorly, each with several (usually 4 or 5) setae at and before middle and 1 before basal angle; disc with middle line distinct, transverse impressions weak; baso-lateral foveae rather deep but vaguely limited, with weak convexities toward lateral margins, and closely transversely strigulose, the strigulations extending onto disc across base. *Elytra c.* 1/4 wider than prothorax, widest behind middle; forming *c.* right (slightly obtuse), slightly dentate angles at humeri; striae indicated by weakly punctate impressions; even intervals slightly convex, odd ones 3, 5, and 7 subcostate to costate on disc, 7th strongest and sharply carinate anteriorly; no 10th interval; each 3rd interval usually 2-punctate, with punctures behind middle and on declivity. Mesosternum and prosternal process not setose. Male front tarsi slightly dilated, 3 segments squamulose. Length 24-30; width 8.5-10.3 mm.

Holotype ♂ (M. C. Z. Type No. 30,363) and 33 paratypes all from the Mt. Spec plateau (Paluma Range), *c.* 40 miles north of Townsville, North Queensland, 2000-3000 ft., Nov. 1957 and Feb. 1958, taken by the Darlingtons in or on the edges of rain forest.

In spite of their wide geographical separation, this species and *superbus* Cast. (of New South Wales) may represent one original stock. The new species resembles *superbus* in form, color, and many details, but differs from it in having only 2 (instead of 3) supra-ocular setae on each side and in having better defined posterior prothoracic angles.

Trichosternus setosiceps Sl.

Sloane (1923, p. 23) described *setosiceps* from the South Johnstone River and Malanda, which are on or near the Atherton Tableland. The species is widely distributed on the Tableland, except apparently the northern part, and reaches the lower slopes of Mt. Bellenden Ker and extends south to the Kirrama Range.

This species differs from all other *Trichosternus* in having 2 segments of each male front tarsus squamulose.

Trichosternus kirrama new species

Form as figured (Fig. 3), large, with strongly cordate prothorax and oval elytra; black, head and prothorax moderately shining, elytra dull. *Head* large, 4/5 or slightly more width prothorax; eyes small, genae slightly wider than eyes, broadly rounded and narrowed posteriorly to neck; antennae rather long, passing base of prothorax by *c.* 2 segments; 2 or 3 supra-ocular setae each side (often asymmetrical); frontal foveae as usual except area between them slightly depressed and/or with longitudinal prominences outside them. *Prothorax* strongly cordate, nearly 1/2 wider than long at middle; base *c.* 4/5 (±) width of apex; apex emarginate at middle, rounded toward sides, with angles (lateral channels) advanced; apex not margined; base broadly emarginate except subtruncate near angles, rather irregular, vaguely margined; sides rounded through much of length, strongly sinuate about 1/6 before base, thence subparallel to *c.* right, well defined posterior angles; lateral margins moderate anteriorly, slightly wider posteriorly, each 2 to 4 (rarely 5) setae at and before middle and one a little before base; disc with usual middle line, transverse impressions weak; baso-lateral impressions irregular, transversely strigulose, the strigulose area extending forward at sides and across base; extreme basal strigae longitudinal. *Elytra* 1/5 or slightly more wider than prothorax; margin somewhat obtusely angulate but only vaguely toothed at humeri; striae formed by lines of small punctures; even intervals slightly convex, odd intervals 3 and 5 slightly more raised but not costate, interval 7 strongly raised, costate at base; no 10th interval; each 3rd interval 2-punctate, behind middle and on declivity. Mesosternum and prosternal process not setose. Male front tarsi moderately dilated, 3 segments squamulose; 2 or 3 (often asymmetrical) setae each side last ventral segment in both sexes. Length 30-33; width 9.9-10.6 mm.

Holotype ♂ (M. C. Z. Type No. 30,364) and 11 paratypes all from Kirrama Range, near Cardwell, North Queensland, 2000-3000 ft., Dec. 1957 and Feb. 1958, taken by the Darlingtons, in rain forest.

In form, appearance, and some characters (near obliteration of

humeral teeth, lowness of elytral intervals) this species approaches *obscuripennis,* but the arrangement of setae is very different. I do not know the real relationships of either species.

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ADRITYLA, A NEW MILLIPED GENUS (CHORDEUMIDEA: CONOTYLIDAE)

By Nell B. Causey[1]

Introduction

This is the second of a series of papers on the widely dissimilar North American species formerly assigned to the genus *Conotyla.* In the first (Causey, 1961), the genus *Austrotyla* was proposed for *coloradensis, humerosa, montivaga,* and *specus.* The remaining species will be reviewed and the basal region of the gonopods described in subsequent papers.

A grant from the National Science Foundation (G-14486) made the completion of this paper possible.

I am grateful to Dr. Herbert W. Levi for the loan of the specimens of *Conotyla deseretae* in the Museum of Comparative Zoology.

Genus **Adrityla,** new

Type species. Conotyla deseretae Chamberlin, 1910, by monotypy.

Diagnosis. Large bodied (length to 24 mm.), pigmented conotylinids of 30 body segments, distinguished especially by the modification of legpair 10 (8^1), of which the coxa is greatly enlarged and lobate and the telepodite is reduced to 2 or 3 minute segments. The sternum of the anterior gonopods is divided, and the small sternites are fused to the base of the gonopods. The latter are unsegmented and larger than the coxites of the posterior gonopods.

Relationships. The inclusion of this genus in the subfamily Conotylinae is justified by the following sexual characters of the male: the unsegmented anterior gonopods, the retention of a division between the coxal and prefemoral segments of the posterior gonopods, and the absence of coxal glands on legpair 11 (8^2). The divided sternum of the anterior gonopods suggests a close relationship with the *Austrotyla-Taiyutyla* line rather than with *Conotyla,* which has this sternum undivided. The remarkable modification of legpair 10 surely occurred independently in *Adrityla,* as it has in other widely separated chordeumids.

Distribution. Utah.

Adrityla deseretae (Chamberlin), new combination

Figures 1-4

Conotyla deseretae Chamberlin, 1910, Ann. Ent. Soc. Amer. 3(4):235-236, pl. 31, figs. 3-8; pl. 32, figs. 1-7. Loomis, 1943, Bull. Mus. Comp. Zool. Harvard 92(7):381. Chamberlin and Hoffman, 1958, U. S. Nat. Mus. Bull. 212:98.

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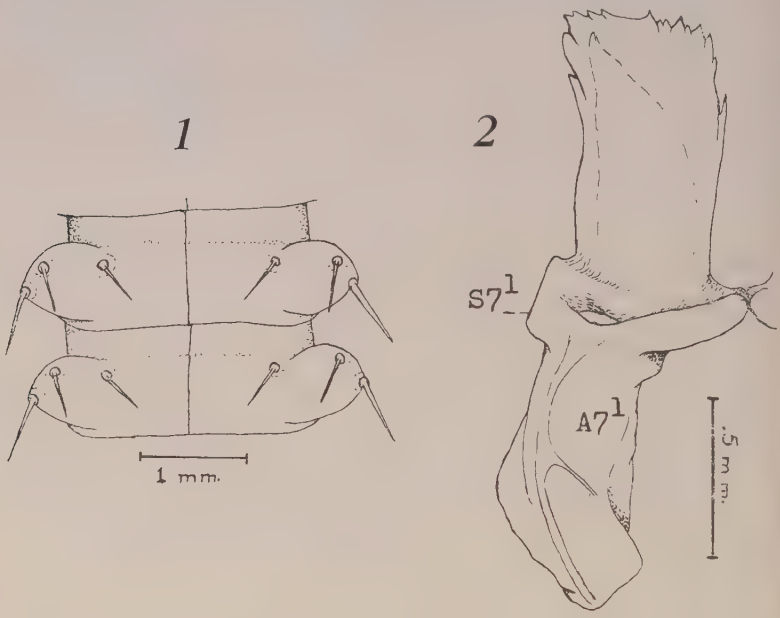
Types. Present location of male holotype unknown. Two larvae, undoubtedly metatypes, from Mill Creek Canyon, Salt Lake Co., Utah, and my plesiotypes (♂, ♀) from South Willow Canyon, Tooele Co., Utah, are in the Museum of Comparative Zoology.



Figures 1, 2. *Adrityla deseretae* (Chamberlin). 1. Segments 10 and 11, dorsal view. 2. Left anterior gonopod, anterior view.

Type locality. The Wasatch Mountains, Salt Lake Co. and Utah Co., Utah.

Range. The Wasatch Mountains in central and northern Utah (Chamberlin and Hoffman, 1958).

Description. Length 22 to 24 mm., width 2.6 to 3 mm., the ♂ larger than the ♀. Body reaches its greatest width at segment 8 or 9. Dorsum with a dark brown medial longitudinal band; pleura with a brown longitudinal band along the lower surface of the paranota; venter, legs, and remainder of dorsum light brown to yellowish; antennae dark brown. Ratio of length and width of collum approximately ½. Paranota with the typical conotylinid shape and position are on segments 2 through 25 (Fig. 1). Segmental setae acute; on typical segments the external setae are markedly longest, about 0.5 mm., and the medial and internal (nearest the dorsomedial furrow)

setae are about 0.35 mm.; the relative distances between them are as follow:

$$\frac{\text{med. seta} - \text{ext. seta}}{\text{med. seta} - \text{int. seta}} = \frac{1}{3} \qquad \frac{\text{dorsal furrow} - \text{int. seta}}{\text{int. seta} - \text{med. seta}} = \frac{1}{3/4}$$

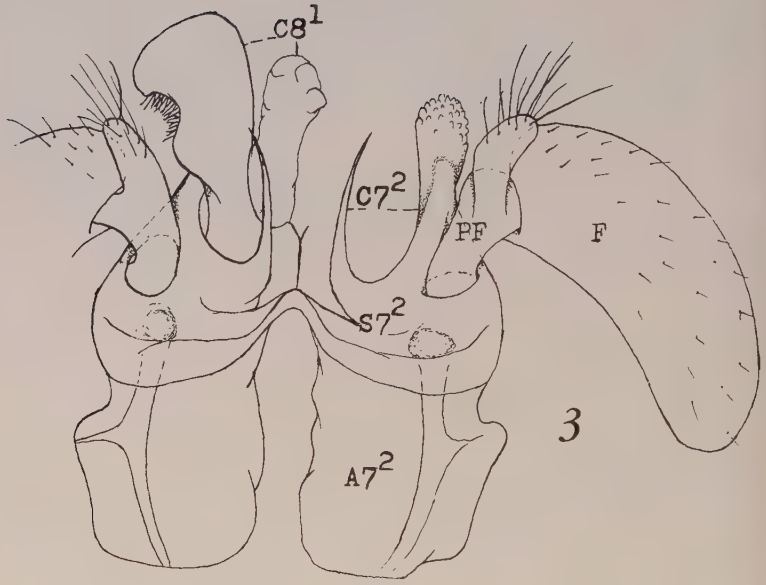
Mentum undivided. Clypeus, frons, and vertex with the usual short, unequal setae. Eyes triangular, from 23 to 25 black ocelli arranged compactly, but not touching, in rows of 1, 7, 6, 5, 4 (3), 2 (1), Antennae slender, the length approximately 4.3 mm. in the ♂ and 3.3 in the ♀.

In the male, legpairs 1 and 2 are about two-thirds the length and thickness of the following legs; legpairs 3 through 7 are shorter and thicker than the postgonopodal legs and segment 4 bears an inconspicuous rounded protuberance on the mesioproximal surface; the ventral surface of the coxa of legpair 7 is conspicuously swollen; the ventral surface of the tarsus of all legs from the third to about the middle of the body is pulvillar; legpair 10 (8^1) is highly modified by the enlargement of the coxa and the coxal sac and by the reduction of the telopodite; and legpair 11 (8^2) has the coxa slightly swollen but lacks a coxal sac or coxal perforation; the ectoventral surface of segment 2 of legpair 11 bears a small, rounded, caudally directed lobe.

The anterior gonopod (Fig. 2) is an unsegmented, rectangular piece irregularly serrated on the ventral margin and directed down and slightly forward. In the coxosternal region it is contiguous with its homologue along a movable suture. The spiracle opens into a large depression near the anterior margin of the coxosternum.

The posterior gonopod (Figs. 3 and 4) consists of the usual three segments: 1) a coxa with two elongated coxites, the mesial one inconspicuous and narrowly attenuated, and the more lateral one longer, stouter, clavate, warty on the apical surface, and covered distad by the larger coxite of legpair 10; 2) a slender prefemur (one-third the length of the femur) with a setose lobe on the mesiodistal surface; and 3) a large oval femur (the ratio of the length to the thickness is 1/3) with an irregular pigmented pit on the caudal surface near the apex. The sternum is thin in the midline and bent sharply ventrad; laterad it is fused with the coxae and thickened; the spiracles open from large pigmented pits near the ectocephalic angles.

Leg 10 consists of two regions: 1) an enlarged coxosternum with one massive coxite that curves back over leg 11 and covers the apical region of the larger of the two coxites of the posterior gonopod, and 2) a minute telopodite of 2 or 3 unequal segments that cannot be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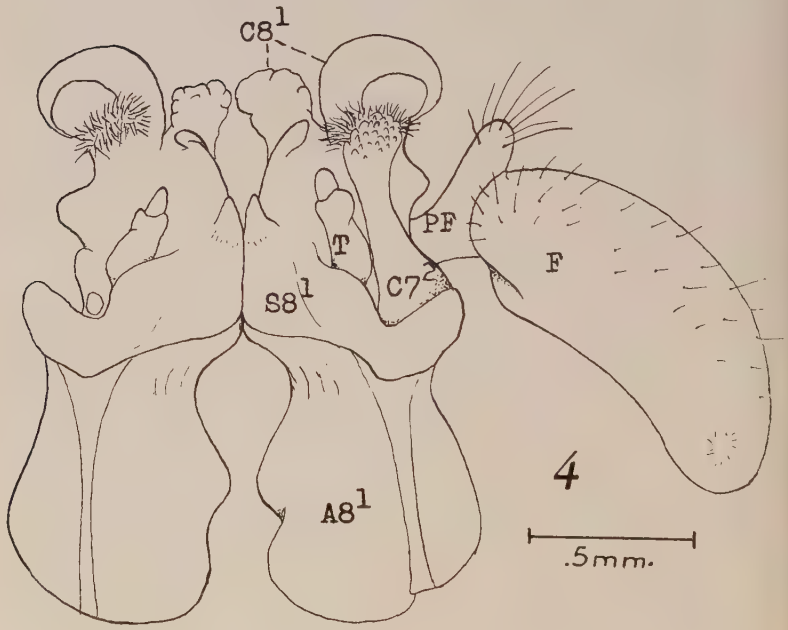
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seen unless leg 11 is removed. The coxite is elongated, broadened and rounded distad, smooth on the anterior surface, and thickly setose over part of the more complex posterior surface; a subapical flange is on the ectal surface, and near the base of the mesial surface is a large perforation through which the enlarged, soft coxal sac projects. The coxal sac is contiguous with its homologue in the midline. The sternum is divided and coalesced with the coxa, forming a thick, short coxosternum which is contiguous with its homologue along a movable suture; the inconspicuous spiracles open on the ectal surface of the coxosternum.

Appendages 7^2 and 8^1 (the posterior gonopods and legpair 10, respectively) fit close together, but there is no fusion, and with careful dissection they can be completely separated.

In the female, the setae on the vulvae are unusually long. The legs are typical of the family.

Emendations. In the original description, Chamberlin (1910, p. 236) incorrectly interpreted the coxites of legpair 10 (8^1) as part of the anterior (7^1) and posterior (7^2) gonopods. The correct legends of plate 31, figures 4-7 are: figure 4, legpair 10, caudal aspect; figure 5, anterior gonopods and parts of posterior gonopods and legpair 10, cephalic aspect; figure 6, left gonopods and tenth leg, lateral aspect; posterior gonopods, cephalic aspects. Only legpairs 4 and 5 were represented (Pl. 32, Figs. 2-6) as having a small lobe on the mesioproximal surface of segment 4. I have found that legpairs 3 through 7 have segment 4 similarly modified; possibly there is some variation of this character. A large promentum was indicated in plate 32, figure 7. There is no promentum; the small triangular space anterior to the mentum is covered only by a membrane.

Variations. The ventral margin of the anterior gonopods is irregularly serrated in each of the 4 male specimens that I have examined. The serrations vary between 3 and 14 or 15. A possible variation in the lobation of the pregonopodal legs was mentioned in the preceding paragraph.

Material Examined. UTAH: Mill Creek Canyon, Salt Lake Co., larvae (MCZ) [? metatypes]; South Willow Canyon, Tooele Co.,

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Figures 3, 4. *Adrityla deseretae* (Chamberlin). 3. Posterior gonopods and left tenth leg, anterior view. 4. Left posterior gonopod and legpair 10, posterior view. (Abbreviations: $A7^1$, $A7^2$, $A8^1$, sternal apodemes of anterior gonopod, posterior gonopod, and leg 10, respectively; $C7^2$, $C8^1$, coxites of posterior gonopod and leg 10, respectively; F, PF, femur and prefemur of posterior gonopod, respectively; $S7^1$, $S7^2$, $S8^1$, coxosternites of anterior gonopod, posterior gonopod, and leg 10, respectively; T, telopodite of leg 10.)

July 5, 1953, 1 ♂, 1 ♀, W. D. Hester (MCZ); American Fork Canyon, Timpanogos Park, Utah Co., June 14, 1952, W. D. Hester, 3 ♂. 8 ♀, larvae (NBC).

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ANTS FROM THREE REMOTE OCEANIC ISLANDS

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The three islands (Raoul, Clipperton, St. Helena) whose ant faunas are described below have in common only extreme geographic isolation. That ants occur on them at all confirms the idea that these insects, with man's help, have now populated every part of the earth capable of supporting them. These and other remote oceanic islands will undoubtedly attract more of the ecologist's attention in the future, since many animal taxa inhabiting them, including most or all of the ant species, have only arrived within historical times and present simple case histories of faunas in the first stages of local adaptation.

We are grateful to Dr. J. S. Edwards, Dr. C. F. Harbinson, Mr. Arthur Loveridge and Dr. B. A. Holloway of the Dominion Museum, Wellington, New Zealand, for making these unusual collections available. The study has been supported in part by a research grant from the National Science Foundation.

Raoul Island, Kermadec Islands

The Kermadecs are a group of forest-clad volcanic islands lying in the South Pacific between S. lat., 29.10 and 31.30; and W. long., 177.45 and 179.00. The nearest sizable land mass is the North Island of New Zealand, about 650 miles to the southwest, and the nearest major Polynesian island is Tongatabu of the Tongan group, about 700 miles to the north. Australia lies about 1,700 miles to the west.

The ants listed below were taken on Raoul or Sunday Island, the largest of the group (11.25 sq. miles), or on its tiny outlier, Meyer Island. Most of the material was collected during June 1956 for the University of Auckland, New Zealand, by Dr. J. S. Edwards of Cambridge University. A few records are from the collections of the Museum of Comparative Zoology, Harvard University, or from the Dominion Museum, Wellington, New Zealand. Unless otherwise noted all collections were made by Dr. Edwards.

The collection includes a number of Berlese funnel samples as well as hand-collected specimens, and although only three species are listed, it is thought that they represent most, if not all, those present on Raoul in 1956.

Ponera gleadowi Forel

The systematics and distribution of this ant have been discussed by Wilson (1958). *P. gleadowi* is a widespread species, originally

described from India, and found throughout South East Asia, Melanesia and Polynesia. It is apparently native throughout most of its range, but may have been distributed in part by man (i.e., it is a member of "Class II" discussed below).

Material examined: RAOUL ISLAND: June 5, 1956; under rock, watercourse, June 8, 1956 (nest with ergatomorphic male pupae); ex Pohutakawa logs (*Metrosideros* sp.), June 3, 1956. Crater: June 4, 1956; ex moss caps on pumice boulders, June 4, 1956; ex Pohutukawa log, June 4, 1956 (nest with alate queens). Denham Bay: ex *Narcissus* litter Berlese funnel sample, June 7, 1956. Denham Bay swamp: ex Pohutakawa litter Berlese funnel sample, June 2, 1956. Hostel Bay: Berlese funnel sample, June 7, 1956; *Coxnocarpus* litter Berlese funnel sample, June 8, 1956. Oneraki Beach: beneath cow dung under trees, June 9, 1956 (J. S. Soeberg). MEYER ISLAND: Berlese funnel samples, June 7, 1956; June 16, 1956.

Ponera gleadowi is apparently the most abundant ant on Raoul and was "commonly found (by Dr. Edwards) under stones or in decaying logs or branches, frequently associated with termites." Moreover it was present in about half of the Berlese funnel samples processed by Dr. Edwards. As indicated, winged queens are present in the nests during June. No adult males were located, but several pupae from the nest collected on June 8, 1956, were found to contain almost fully developed ergatomorphic males. Except for genital differences these are similar to the workers, and like them have twelve-segmented antennae.

Tetramorium guineense (Fabricius)

This is one of the most common pantropical formicid tramp species. It evidently originated in Africa and ranges widely throughout the Old and New World tropics, and Northern Australia. It is widespread in Polynesia (Wheeler, 1935) and has recently been found established near Auckland, New Zealand. Dispersal by man has clearly been of primary importance in the distribution of this species.

Material examined: RAOUL ISLAND: June 4, 1956; quarry, under rock, June 5, 1956, (nest with alate females). MEYER ISLAND: Berlese funnel sample, June 7, 1956.

Monomorium antarcticum (White)

At present the name *M. antarcticum* is applied to what is almost certainly a complex of species found in New Zealand and its outlying islands, including the Chatham group, some 470 miles to the east

of South Island. It has undoubtedly been carried to the Chatham Islands by man (Brown, 1958). (It is further likely that *Monomorium rapaënse* Wheeler (1936) of Rapa Island in the Austral group, is conspecific with some New Zealand form belonging to the present *M. antarcticum* complex. If this should be so the fact that New Zealand and Rapa were both important whaling ports in the nineteenth century may be significant with regard to the dispersal of this form.)

Material examined: RAOUL ISLAND: Crater: nest in warm soil beside fumarole, June 3, 1956. Four workers without further data from the M. C. Z. collection.

The M. C. Z. specimens were studied by Wheeler in preparing his 1935 paper and were probably collected by the W. R. B. Oliver expedition to Raoul Island during 1907-08. Wheeler apparently intended using these specimens as the types of a new species, to be described in a later paper which, however, was never published due to his death. It seems unlikely that they are specifically separate from some North Island samples of the *antarcticum* complex, and they have almost certainly been introduced to Raoul from New Zealand.

The Kermadec ant fauna is thus characterized by a lack of endemic or native species and includes forms derived either from tropical Polynesia, or the nearest large land area, and known to have capacities for passive dispersal by man. The faunal tally of only three species is probably well below the possible maximum carrying capacity of the island (see Wilson, 1961). Although the present human settlement on Raoul consists only of the staff of a weather station, there have been several attempts to colonize it in the past. The parties concerned are known to have travelled from Fiji and New Zealand, and to have carried much produce as well as plants and seeds, thus providing adequate passage for ants. In its relationships and depauperate nature the ant fauna resembles those of other insect groups which have been studied (see Miller, 1956 p. 420 for references).

Some interesting comparisons can be made with the faunas of Lord Howe and Norfolk Islands, which are about the same size as Raoul, and lie at approximately the same latitude, but much closer to Australia.

The ants of these three islands may be grouped for analysis into three classes.

Class I. Species which are probably native to the island concerned. This category includes forms found also in Australia, and endemic species (all of which are clearly derived from Australian stock).

Class II. Species native to, and sometimes widespread in the Indo-Australian region which appear to have been distributed in part by man.

As the islands under discussion are rather peripheral to the main part of the Indo-Australian area it is difficult to estimate whether "Class II" species listed from them are truly native, or whether they have originated from propagules carried by man. This difficulty is especially evident with respect to the Lord Howe and Norfolk Island forms, but in our opinion, it is highly probable that the "Class II" Kermadec species (*Ponera gleadowi* and *Monomorium antarcticum*) were carried to Raoul by man.

Class III. Widespread pantropical or cosmopolitan forms well known as "tramp species" and distributed largely by man.

The numbers of species referable to each of these classes on the islands concerned are shown in Table I.

	Lord Howe Island	Norfolk Island	Raoul Island
South latitude	30° 30′	29° 48′	29° 10′
Size (mi²)	5	13	11.25
Distance from Australia (mi)	400	900	1700
No. ants Class I (endemics bracketed)	10(5)	8(1)	—
No. ants Class II	3	1	2
No. ants Class III	1	3	1
Total number of ants	14	12	3

Table I. Certain geographical features of Lord Howe Island, Norfolk Island, and Raoul Island; with details of the class composition of their ant faunas. Further explanation in text [data based in part on Wheeler (1927), modified by recent revisionary studies].

Although native ants are apparently absent from Raoul they are present on both Lord Howe and Norfolk Islands. The species concerned are all of Australian origin, and more of them are present on Lord Howe than on Norfolk, in spite of the considerably larger size of the latter. Faunal size on these islands is thus negatively correlated with their areas, a reverse situation from that observed by Wilson (1961) in various Moluccan and Melanesian Islands. Judging from the Melanesian faunal curves published by Wilson, we believe that Lord Howe Island probably supports a saturated ant fauna. Norfolk Island, however, would be expected to carry more

species than it does — and considerably more than Lord Howe. The reason for the apparently sub-normal size of the Norfolk Island fauna may be sought in the correlation between faunal size on the two islands and the following two factors:

1. Ecological Diversity: The published reports of the terrain and the state of the vegetation on these islands suggest that Lord Howe is ecologically much more diverse than is Norfolk Island. In spite of its much smaller size it may, therefore, be capable of supporting a larger and more varied ant fauna. Conversely, Norfolk Island may have a lower carrying capacity due to its lower ecological diversity, so that its fauna, although proportionately smaller than that of Lord Howe, is nevertheless saturated.

2. Distance from Australia: The apparent correlation between faunal sizes on these islands and their distances from Australia contrasts with Wilson's (1961) finding in Melanesia, where such correlation is lacking. This situation may be due to the absence of intermediate islands between those under discussion and Australia — islands which might provide assistance as "stepping stones" to colonists. According to this hypothesis the small size of the Norfolk ant fauna is due to the fact that too few species have reached the Island to saturate its carrying capacity.

If mere distance from Australia does have the filtering effect envisaged it may be assumed that there is a maximum range of natural overseas dispersal of the Australian fauna. As far as the ants are concerned, Raoul, in lacking indigenous Australian elements, may be considered to be outside this range.

It is not possible, at present, to evaluate the relative importance of these two factors in determining the size of the Norfolk Island ant fauna, but the problem would certainly be worthy of attention by future field workers in these areas.

Lord Howe Island also has significantly more endemic ant species than has Norfolk; each of these represents a stock which has diverged from its Australian progenitor and in no case has splitting or radiation taken place *in situ* on the island. The ecological diversity of the island, coupled with the competitive pressures which must arise in such a dense fauna, has probably caused this specialization of stocks, with consequent phyletic change to the point of formation of an endemic species in some lineages.

Clipperton Island

Clipperton Island is a lonely coral atoll about four miles in diameter, lying at N. lat., 10.18 and W. long., 109.15. It is 1,800

miles due west of the Panama Canal, and about 670 miles southwest of the nearest part of the Mexican coast. Most of the island is barely 10 feet high, but it rises to about 70 feet at one point. The vegetation consists of grasses, shrubs, and wild tobacco and there are several coconut groves.

The island is now uninhabited but it was occupied by a Mexican garrison from 1879-1917, and by about 100 phosphate miners from 1906-1917. Both of these groups received regular supplies from Mexico. Clipperton was occupied by the United States Navy during the Second World War.

The ants listed below were collected for the Museum of Comparative Zoology by A. M. Peterson and C. F. Harbinson during August 1958; the collection is almost certainly fully representative.

Odontomachus insularis (Guérin)

This species is widespread in Central America and the West Indies, and ranges north to Florida and Georgia. It also occurs on Cocos Island and the Tres Marias Islands in the Eastern Pacific. It is noteworthy that the Island of Clarion in the Revillagigedo group is occupied by a second species, *O. clara* Roger (=*haematoda clarionensis* Wheeler), which is widespread in Mexico and the West Indies. A third far ranging species, *O. bauri* Emery (=*haematoda div. auct.; nec haematoda* L.?), occurs on the Galapagos. All of these exclusively New World species are to be distinguished from the closely similar Indo-Australian *O. simillimus* Fr. Smith, (=*haematoda div. auct.; nec haematoda* L.), which ranges eastwards only to Tahiti. Three series collected.

Tetramorium simillimum (Fr. Smith)

Like *T. guineense* this is a pantropical tramp species of African origin, widespread both in Central America and Polynesia. Its total range closely approximates that of *guineense*. Ten series collected.

Triglyphothrix striatidens (Emery).

A species of tropical Oriental origin, spread by commerce throughout the Pacific, and established in North Africa and Queensland, Australia. Seven series collected.

Like Raoul, Clipperton has a depauperate ant fauna, consisting entirely of species which have probably been introduced by man.

Saint Helena Island

Saint Helena (S. lat., 15.57, W. long., 5.42) is a small volcanic island 47 sq. miles in area, lying in the south Atlantic about 1,800

miles from South America, and 1,200 miles from Africa. The Island differs in several respects from those discussed above, in that it is well populated and is visited more regularly by shipping. Indeed, it has at times been a major port-of-call for trade between Europe, and South Africa and India. The ants listed below have probably all been introduced to the island by man. They were collected for the Museum of Comparative Zoology between 1958 and 1960 by Mr. Arthur Loveridge. The collection is probably less representative than those already discussed, so that no faunal analysis can be attempted at present.

Tetramorium simillimum (Fr. Smith)

The distribution of this species has been discussed above. One series collected at Varneys.

Pheidole megacephala (Fabricius)

This is one of the most widespread and notorious of the commercial tramp ant species, it is now virtually cosmopolitan in warm humid areas. Sandy Bay: under rocks. Prosperous Bay: nest with alates, under rocks, February 24, 1958. Varneys: alate males from a storeroom cabinet, February 19, 1960.

Solenopsis (*Diplorhoptrum*) sp.

The subgenus *Diplorhoptrum* includes a number of taxonomically confused, and in some cases widespread, cryptobiotic species, several of which appear to be commercial tramps. A single series labeled Varneys, 1000 feet.

Plagiolepis alluaudi Forel

This species, probably of East African origin, is a widespread pantropical tramp species. A single series from Varneys.

Paratrechina bourbonica Forel

A widespread pantropical tramp species, apparently of African origin. A single series from Varneys.

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STUDIES ON CARBONIFEROUS INSECTS OF COMMENTRY, FRANCE: PART III. THE CALONEURODEA

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Introduction

This is the third in a series of papers redescribing certain of the Carboniferous insects of the Commentry Basin, France.[1] It treats those Commentry species which now appear to belong to the order Caloneurodea. This extinct order was erected by Martynov in 1938 for the Carboniferous family Caloneuridae and for related families represented in Permian deposits of the USSR. It now includes additional families established by Carpenter (1943) for Permian species from Kansas. At the present time seven families are known in the order and of these only one, the Caloneuridae, is of Carboniferous age. The Commentry specimens are by far the most important of the Caloneuridae but Handlirsch's and Meunier's publications have given us a superficial and confused knowledge of these fossils. The present paper, which is based upon direct study of all the known Commentry material, consists of redescriptions of the fossils and a revision of their taxonomic assignments.

Survey of Commentry Species

A historical account of the Commentry collections and of the general literature on the insects was included in the first part of this series of papers (Carpenter, 1943). Among the species first described by Brongniart (1885) from the Commentry shales was a single specimen, designated *Caloneura dawsoni*, and assigned to the family Palaeacridiodea of the order Orthoptera. In his later monograph of the Commentry insects (1894) Brongniart included drawings of five additional specimens of *dawsoni* and gave a more extensive account of the genus, which he placed in the same family, designated at that time as Palaeacrididae. Handlirsch, in his 1906 treatise, established the family Caloneuridae for the genus, assigning it to the extinct order Protorthoptera.

[1]This research has been aided by a grant (NSF-G14099) from the National Science Foundation and by a previous grant (1938) from the Penrose Fund of the American Philosophical Society. I am indebted to the authorities of the Laboratoire de Paleontologie of the Muséum National d'Histoire Naturelle in Paris for placing at my disposal the unique collections of Commentry insects in the Muséum, both in 1938 and in 1961; and to the authorities of the British Museum (Natural History) for allowing me to examine the Commentry fossils in that institution.

In 1917 Lameere, following an examination of the Commentry fossils in the Muséum in Paris, placed in the Caloneuridae two species *(similis* and *royeri)* which Meunier had originally described (1911) in the order Paleodictyoptera. At about the same time (1919) Handlirsch described four more species of *Caloneura,* all based on the Commentry specimens illustrated in Brongniart's monograph (1894). Finally in 1925 Bolton described an additional species *(subtilis)* from Commentry in the British Museum (Natural History) and also figured a specimen of *dawsoni* included in the same collection.

As a result of my examination of all of these fossils and of additional specimens in the Muséum in Paris, not previously published upon, I propose the following classification of the Commentry Caloneurodea:

Family Caloneuridae Brongniart

Genus *Caloneura* Brongniart (synonym: *Confusio* Handlirsch)
dawsoni Brongniart (synonyms: *picta* Handlirsch, *major* Handlirsch, *longicornis* Handlirsch, *robusta* Handlirsch, *royeri* Meunier).

Family Apsidoneuridae, new (type species, *Apsidoneura flexa* Carp., Permian Kansas)

Genus *Homaloptila* Handlirsch
similis Meunier

The Commentry species which Bolton (1925) described as *Caloneura subtilis* (British Museum [Natural History], type 17280) is not, in my opinion, a caloneurid or even a member of the order Caloneurodea. However, since the poor preservation of the specimen prevents satisfactory determination even to order, I refer this species to Insecta Incertae Sedis.

Family Caloneuridae Handlirsch

Fore and hind wings similar. Sc terminating well before the wing apex; CuA and CuP very close together and nearly parallel; MP forked nearly dichotomously; 4 anal veins; cross veins numerous. Body and legs slender.

This family is known only by the genus *Caloneura.* The Carboniferous genera *Caloneurella* Carp. (Pennsylvania) and *Pruvostiella* Handl. (Nord, France), both of which have previously been placed here, should probably be included under Caloneurodea Incertae Sedis.

Genus *Caloneura* Brongniart

Caloneura Brongniart, 1885, soc. Amis Sci. Nat. Rouen., 21:59; 1894, Recherches Hist. Ins. Foss.: 562. Handlirsch, 1906, Foss. Ins.: 141. Carpenter, 1943, Proc. Amer. Acad. Arts Sci., 75:69.

Confusio Handlirsch, 1919, Denkschr. Acad. Wiss. Wien, 96:37 (New synonymy).

Fore wing with a somewhat broader costal space than the hind wing

and with the costal space abruptly narrowed basally; hind wing narrower at base than the fore wing and with the costal margin nearly straight basally. Rs with five or six main branches, one of these usually having a short distal branch. MP usually forked, CuA and CuP unbranched.

Type species: *Caloneura dawsoni Brongniart.*

Confusio was based upon *royeri,* which Meunier described in the palaeodictyopterous genus *Homaloneura,* and which I consider a synonym of *dawsoni.*

Caloneura dawsoni Brongn.
Figure 1

Caloneura dawsoni Brongniart, 1885, Soc. Amis Sci. Rouen, Bull., 21:59, pl. [4], fig. 2; 1894, Recherches Hist. Ins. Foss.,: 562, pl. 36, fig. 5-11. Lameere, 1917, Mus. Nat. Hist. Natur. Bull., 23:181. Handlirsch, 1919, Denkschr Akad Wiss., 96:35, fig. 36. Bolton, 1925, Brit. Mus. Fossil Insects. 2:15, fig. 5.
Caloneura picta Handlirsch, 1919, *ibid.,* p. 35, fig. 37.
Caloneura major Handlirsch, 1919, *ibid.,* p. 35, figs. 38, 39.
Caloneura longicornis Handlirsch, 1919, *ibid.,* p. 35, fig. 40.
Caloneura robusta Handlirsch, *ibid.,* p. 36, fig. 41.
Homaloneura royeri Meunier, 1911, Bull. Mus. Nat. Hist. Natur., 17:119, fig. 2; 1912, Ann. Paleont., 7:9, pl. 7, fig. 2; Lameere, 1917, Mus. Nat. Hist. Natur., Bull., 23:181.
Confusio royeri Handlirsch, 1919, Denschr. Acad. Wiss., 96:37, fig. 44.

This species was originally based on the single specimen figured in Brongniart's 1885 paper but was later known to Brongniart by five additional fossils, all illustrated in his *Recherches* (1894). Five other specimens (here designated as C1-C5), which have not previously been mentioned in the literature, are contained in the Muséum National d'Histoire Naturelle in Paris. To these may be added the specimen of *dawsoni* described by Bolton (1925), and the type of *royeri* Meunier. Since I am convinced for reasons given below that these thirteen specimens, all of which I have been able to examine, are one species *(dawsoni),* I have used them as a basis of the following account of this insect.

Wings (Figure 1): The fore wing, which is completely preserved in several specimens, is from 45-48 mm in length, and from 10-12 mm in width. The type specimen has a fore wing length of 45 mm and a width of 10 mm. The hind wings of the several specimens are about the same dimensions as the fore wings but are somewhat narrowed basally. The costal area of the fore wing narrows abruptly just at the level of the separation of CuP and 1A. In the hind wing the costal space is not narrowed at this point, continuing its full width as far as it is preserved in all specimens.

The general venational pattern is shown in figure 1, but this is subject to much individual variation. The subcosta terminates on the costal margin well before the end of R1; it does not extend to the apex of the wing as shown by Bolton in his drawing of a specimen in the British Museum. The number of main branches of Rs varies from 5 to 6 in the several specimens showing those veins, but usually one of these branches has a short fork, which occurs most often on R2 or R3. The branching varies in the fore and hind wings (and presumably in the right and left wings) of individual insects. In the holotype specimen (36-5)[2], for example, this fork occurs on R3 in the fore wing but on R2 in the hind wing. MP is less variable; it forks broadly at about mid-wing. In only one specimen (C_4) does either branch of MP clearly fork again (see figure 1), but in several one or both branches

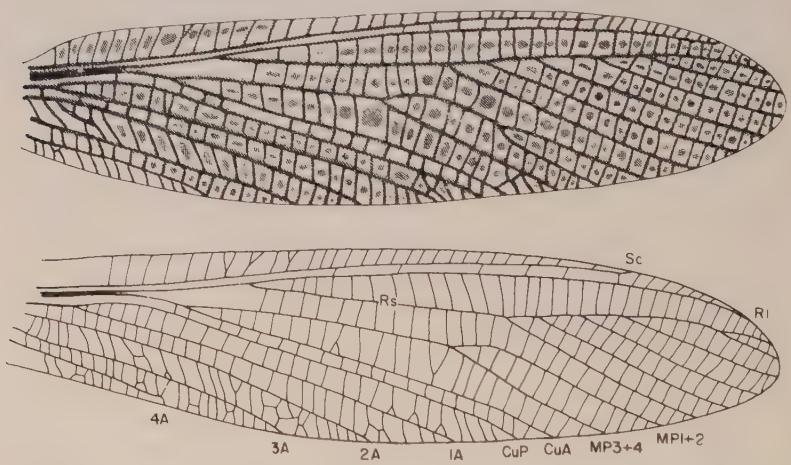

Figure 1. *Caloneura dawsoni* Brongn. Fore and hind wings based on the holotype and other specimens in the Muséum National, Paris. Sc, subcosta (—); R1, radius (+); Rs, radial sector (—); MP1 + 2 and MP3 + 4, branches of posterior media (—); 1A, 2A, 3A, 4A, anal veins.

appear to have a small, terminal fork. CuA and CuP are consistently unbranched; the divergence of CuP and 1A, near the base of the wing, is either shallow or somewhat broader. The four anal veins are consistently present.

The most striking characteristics of the wings of *dawsoni* are the

[2]Since the Commentry insects in the Muséum National are not numbered, I am using here the figure number on Brongniart's plates for the number of the specimen. Hence, specimen 36-5 is the fossil illustrated on Brongniart's plate 36, figure 5.

markings, as mentioned by Brongniart in his original description. The main veins and most of the cross-veins are margined with dark pigment; the veins appear to be very thick but careful examination of the wing shows that the actual veins are only of usual thickness. In addition, nearly all cells of the fore wing contain a dark, irregular pigment spot. The size of the spots varies in different wings but the pattern formed in the wing as a whole is fairly constant. The hind wings appear to be without both types of these markings; at any rate, no specimens that can clearly be recognized as hind wings show them. In a few fossils some of the wings appeared blotched (as in the holotype, 36-5), but the extreme irregularity of this and its absence in other hind wings strongly indicates that it is the result of preservation.

Body structure: Very little is known of the body structure of *dawsoni*. Several specimens show fragments and portions of the thorax and four specimens (36-8, 36-9, 36-10, 36-11) include parts of the legs and antennae but the abdomen is entirely unknown. The legs are slender, nearly homonomous and apparently cursorial. The fore and middle legs are about 34 mm long and the hind legs, 45 mm long. The dimensions of the leg segments are given in Table 1. The tarsi of all three pairs of legs are about the same length.

	Femur	*Tibia*	*Tarsus*
Fore leg	12 mm	10 mm	12 mm
Middle leg	12 mm	10 mm	12 mm
Hind leg	18 mm	15 mm	12 mm

Table 1. Dimensions of leg segments in *Caloneura dawsoni* Brongn.

The femora and tibiae of the fore and middle legs are about the same length, but the hind femur and tibia are slightly longer than those of the other pairs. The antennae are obviously long and slender, though they are not completely preserved in any fossil. In specimen 36-10 one antenna is preserved to the edge of the rock containing the specimen; the preserved part is 55 mm long, which is considerably in excess of the wing length.

So far as known, therefore, the body structure of *dawsoni* is similar to that of the best-known Permian species, *Paleuthygramma tenuicornis* Mart. (see Martynov, 1938b, p. 126).

Synonymy: As mentioned above, Brongniart figured in his *Recherches* (1894) five speciments of *dawsoni* which were not known to him when he described the species in 1885. In 1919 Handlirsch, basing his conclusion on Brongniart's illustrations, established four

additional species for these fossils: *picta, major, longicornis,* and *robusta.* No specific characteristics were even mentioned for *robusta* and those used for the others involved the nature of the branching of Rs. Having examined all these specimens, I cannot accept any of Handlirsch's species as valid.

Meunier's *royeri,* originally placed in the paleodictyopterous genus *Homaloneura,* was transferred to the Caloneuridae by both Lameere (1917) and Handlirsch (1919), the latter making the new genus, *Confusio,* for it. Meunier's drawing of the fossil (1911, p. 119, fig. 2), although incorrect in many details, was more accurate than Handlirsch's (1919, p. 37, fig. 44), which was based solely on the small photograph contained in Meunier's later account (1912). The wing, which I have examined at the Paris Muséum, is characteristic of *dawsoni:* Rs has six branches and MP is forked as usual in the species, — not narrowly branched as in Meunier's figure or unbranched as in Handlirsch's. CuP and 1A are close together, as usual, not widely separated as represented by Meunier. This specimen is clearly *dawsoni* and since the costal margin is straight (not curved as in Meunier's figure), it is almost certainly a hind wing.

Specimens studied: The following is a list of the specimens of *dawsoni* which are now known and which I have been able to examine. In the Muséum National, Paris; (1), no. 36-5, the holotype of *dawsoni,* consisting of a nearly complete fore wing and two overlapped hind wings. (2), no. 36-7 (type of *picta* Handl.), distal two-thirds of a hind wing. (3), no. 36-8 (syntype of *major* Handl.), a nearly complete insect, with the fore wings overlapped and the hind wings also overlapped; some parts of thorax and legs. (4), no. 36-9 (type of *longicornis* Handl.), a wing base, parts of thorax, legs and antennae. (5), no. 36-10 (type of *robusta* Handl.), wing bases, portions of thorax, legs, antennae. (6), no. 36-11 (syntype of *major* Handl.), nearly complete fore wing, basal third of hind wing, parts of thorax and legs. (7), no. C1, two overlapped wings, probably hind, bases absent. (8), no C2, a well preserved fore wing, showing details of fore wing and posterior margin, parts of thorax and legs. (9), no. C3, distal third of a wing, probably hind. (10), no. C4, a very clear fore wing, and basal parts of a hind, parts of thorax and legs. (11), no. C5, basal half of a hind wing. posterior margin very clear. (12), the type of *royeri* Meunier, a nearly complete hind wing, lacking only the very base. In the British Museum (Natural History), London: (13), no. I7292, consisting of at least three (probably four) overlapped wings; also parts of thorax and legs, poorly preserved. Bolton

(1925) was in error in describing a large precostal area in this fossil; he apparently did not realize that more than two wings were overlapped, resulting in a confused jumble of veins.

Apsidoneuridae, new family

Fore and hind wings similar. Sc extending to about the apex of the wing; CuA and CuP very close together and nearly parallel; MP forked broadly and unevenly, the anterior branch (MP 1+2) arching strongly away from MP 3+4; 3 anal veins; cross-veins numerous. Body unknown.

This family is related to the Caloneuridae but differs in the length of Sc, the number of anal veins and the nature of the fork on MP. It is based on the type-genus *Apsidoneura* Carpenter (Permian, Kansas), which was originally placed in the Permian family Paleuthygrammatidae. Study of additional specimens of Caloneurodea from Permian strata of Oklahoma and of the type of *similis* from Commentry has led me to conclude that *Apsidoneura* and *Homaloptila* represent a distinct family.

Genus *Homaloptila* Handlirsch

Homaloptila Handlirsch, 1919, Denkschr. Acad. Wiss., *96*:36.

Rs with four main branches, one of these usually having a terminal fork; MP 3+4 continuing in a nearly straight line the stem MP, which arises from CuA at a considerable distance from the separation of CuA from R. In *Apsidoneura,* MP arises from R or the junction of R and CuA.

Type-species: *Homaloneura similis* Meunier. This is the only species known in the genus.

Homaloptila similis (Handlirsch)

Figure 2

Homaloneura similis Meunier, 1911, Bull. Mus. Nat. Hist. Natur., 17:118, fig. 1. 1912, Annal. Paleont., 7:8; fig. 6; pl 6, fig. 5.
Homalopt la similis Handlirsch, 1919, Denkschr. Akad. Wiss. *96*:36, fig. 42, 43.

Fore wing: length, 30 mm., maximum width, 7 mm. Rs with four main branches, at least two of which are forked distally. MP 1+2 arched away from MP 3+4 as characteristic of the family, but curved strongly towards MP 3+4 distally. There is a tendency for the formation of an irregular network of cells in the distal parts of Rs and MP. Base of wing slender but not as slender as in *Apsidoneura flexa.* Hind wing: similar to the fore wing in size and venation but having a straight costal margin towards the base. The venational pattern is shown in figure 2.

Holotype: Muséum National, Paris. This is a well preserved specimen showing a fore wing and hind wing, their bases overlapped but otherwise independent. The veins are distinct and can be clearly seen under good illumination.

Meunier's drawing of this specimen is incorrect and misleading; he completely overlooked in both wings the fork on MP and the proximity of CuA and CuP. Handlirsch's drawing, based on Meunier's

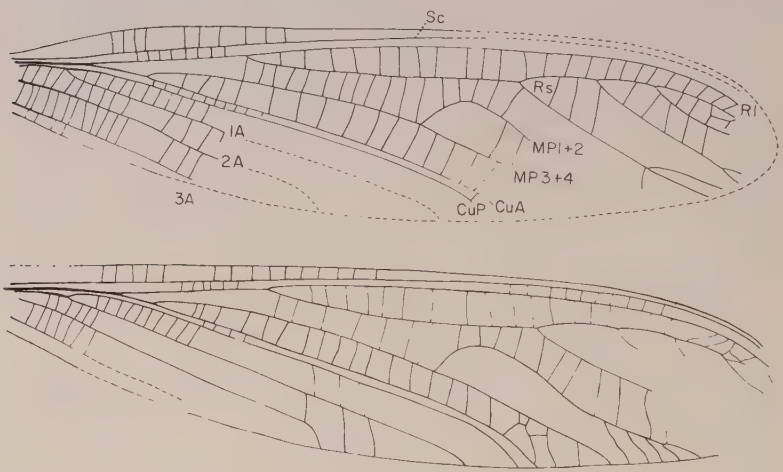

Figure 2. *Homaloptila similis* (Meunier). Fore and hind wing, based on holotype in Muséum National, Paris. Lettering as in figure 1.

published photograph, was equally inaccurate, showing the hind wing with a broad anal area. However, even though the wings are slightly overlapped basally, the margins of the wings are distinct.

The presence in the Commentry shales of this genus, allied to *Apsidoneura,* is an interesting example of a Permian element in the Commentry fauna. A similar occurrence was noted (Carpenter, 1943) in the Order Protodonata, the genus *Meganeurula* of Commentry being virtually indistinguishable from the Permian genus *Typus.*

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